MICRONOR
automation components

MR320 Series
ZapFREE® Fiber Optic Incremental Encoder System

Installation Guide

Doc No: MR320-INSTALL
Rev A2: 10-31-2011

MICRONOR INC.
750 Mitchell Road
Newbury Park, CA 91320 USA
PH: (805) 499 - 0114
FX: (805) 499 – 6585
sales@micronor.com
www.micronor.com

For Support in Europe:
MICRONOR AG.
Pumpwerkstrasse 32
CH-8105 Regensdorf
Switzerland
PH: +41-44-843-4020
FX: +41-44-843-4039
sales@micronor.ch
www.micronor.com

Notice of Proprietary Rights

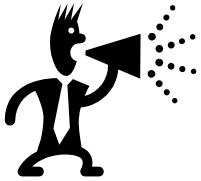
The design concepts and engineering details embodied in this manual, which are the property of MICRONOR INC., are to be maintained in strict confidence; no element or detail of this manual is to be spuriously used, nor disclosed, without the express written permission of MICRONOR INC. All rights are reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from MICRONOR INC.

© COPYRIGHT 2004-2011, MICRONOR INC.
NEWBURY PARK, CALIFORNIA
UNITED STATES OF AMERICA

This Setup Guide is intended to guide you through the installation and initial setup. A comprehensive User Manual is supplied on the Zappy™ CDROM (supplied with the MR320 module) or can be downloaded via this link: http://www.micronor.com/products/files/MR320/ZAPPY.zip

A complete fiber optic encoder system consists of:

- Sensor (MR322, MR324, MR326 or MR328)
- Controller Module (MR320)
- Additional Duplex LC optical assemblies, if required (MR320-D06CXX or user supplied cabling.)
- Additional Duplex LC Mating Adapters, if required to interconnect link cables (MR320C or user supplied)



IMPORTANT SYSTEM NOTES

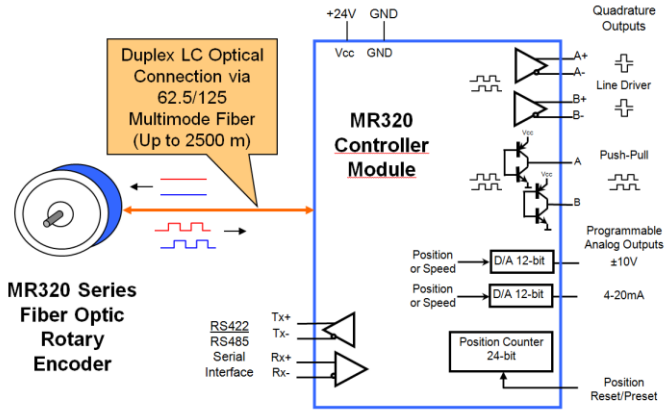
- Always keep Optical Connectors Clean!
- Two-way optical loss cannot exceed 12.5 dB
- Each connector must meet Duplex LC-UPC performance with multimode return loss > 24dB

What optical signals do you need?

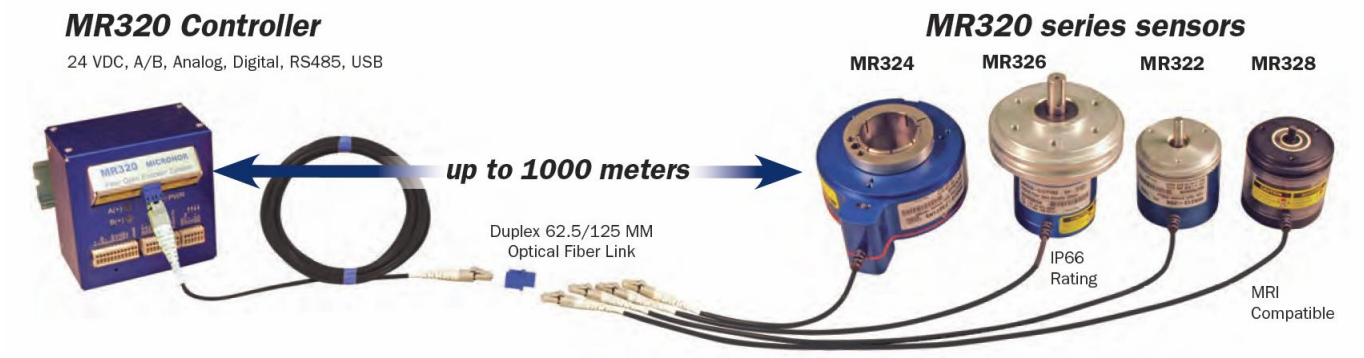
If you require only the direct A+B quadrature outputs, then this Quick Setup Guide is all you should need.

If you plan to use the Multiplier, Divider, Position Counter, Analog Outputs or Serial Interface, then you to need to install the ZAPPY™ software and reference the detailed MR310/MR320 User Manual. These files are included on the Resource CD supplied with the MR320 module or can be downloaded via a single ZIP file at:

http://www.micronor.com/products/files/MR320/ZAPPY.zip



Quick Connections:



Step 1 Connect optical link between Sensor and Module

Step 2 For **A+B push-pull quadrature outputs**, connect to $\mathbf{A_{pp}}$ and $\mathbf{B_{pp}}$ terminals.
For **A+B line driver outputs**, connect to **A+/A-/B+/B-** terminals

Step 3 Connect **+24VDC** to **+Vs** and **0V** to **GND** terminals.

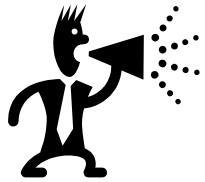
Step 4 For first time installation, it is necessary to "calibrate" the encoder system. ***While rotating the Encoder shaft,*** use the Wago tool to depress the **RESET** button on the Module. If the **A** and **B** LED lights blink ON/OFF, then system is "calibrated" and functioning properly.

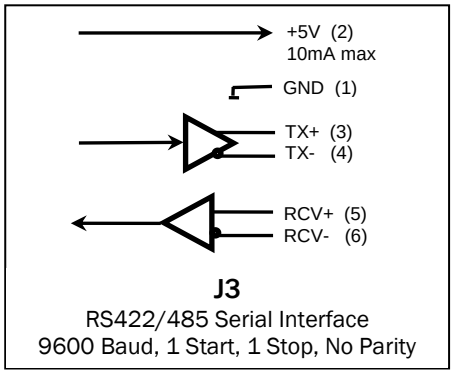
MR320 Electrical Connections:

J1 - Terminal	
1	**A+** Line Driver (5V)
2	**A-** Line Driver (5V)
3	GND
4	**B+** Line Driver (5V)
5	**B-** Line Driver (5V)
6	GND
7	$\mathbf{A_{pp}}$ +24V push-pull
8	$\mathbf{B_{pp}}$ +24V push-pull
9	GND (power)
10	+Vs power(+15V to +32V)
11	Counter RESET (+24V)
12	Shield

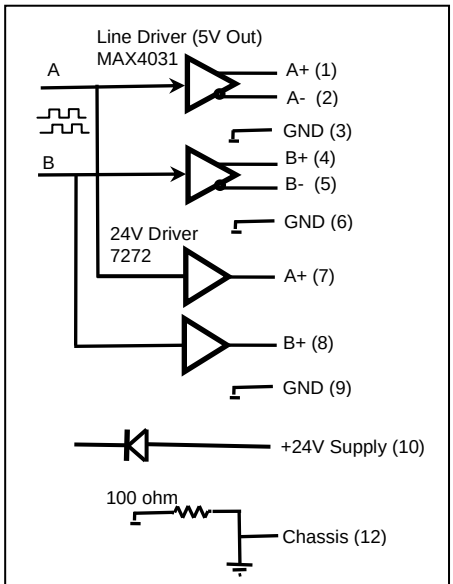
J2 - Terminal	
1	Divider **A+** (5V)
2	Divider **A+** +24V push-pull
3	GND
4	Divider **B+** (5V)
5	Divider **B+** +24V push-pull
6	GND
7	GND
8	-10V to +10V Out (analog)
9	GND
10	4-20mA Out (analog)

J3 RS422/485 Serial I/O	
1	GND
2	+5V Output (10mA max)
3	TX+
4	TX-
5	RCV+
6	RCV-





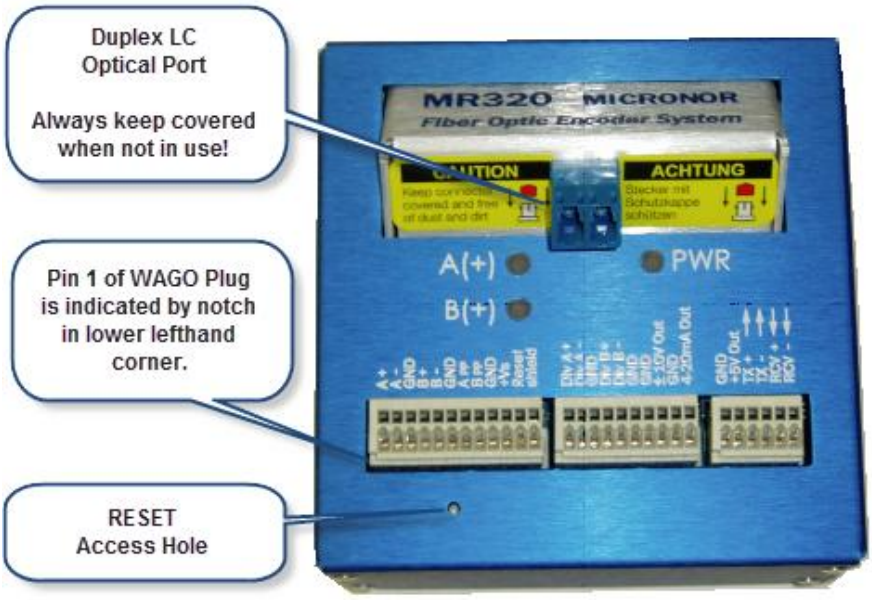
J3
RS422/485 Serial Interface
9600 Baud, 1 Start, 1 Stop, No Parity

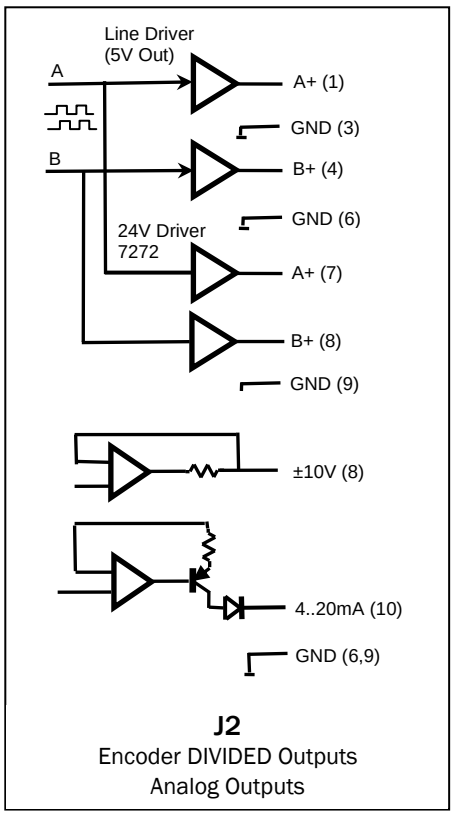


J1
Encoder DIRECT Outputs
Power Supply +15V to +30V

IMPORTANT NOTES:

- Line Driver outputs are short circuit protected.
- The 24V push-pull digital outputs are short circuit protected.
- Avoid any long-term short circuits on outputs. (Max 5 min)
- Analog output polarity (direction) may be inverted by changing the Direction parameter using the ZAPPY™ Setup Program.
- The analog voltage output delivers up to 10mA current and is short circuit protected.
- The current loop output provides 0-24mA





J2
Encoder DIVIDED Outputs
Analog Outputs

Sensor-Module Optical Connection

The optical connection between the Encoder and Sensor must be made using 62.5/125µm multimode optical fiber. This is the same fiber used in local area networks (LANs). **The cable ends must be terminated with high quality Duplex LC and meet these optical performance requirements: Insertion loss <0.5dB, Return loss >24dB, and meets TELCORDIA GR-326-CORE endface geometry specifications.**

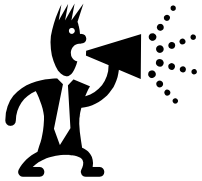
Sensor-Module Initialization:

The first time after initial installation, the MR320 module must be initialized as follows:

- The encoder must be rotating at the same time that the RESET button on the MR320 module is being depressed.
- This initialization calibrates the combination of the sensor, optical link and MR320 control unit. It needs to be executed only once after initial installation – or any time the optical system (loss) is changed.

The RESET button initiates a gain calibration of the optical input amplifier. This procedure may be executed as many times as required. However, once this initial calibration has been performed, the unit will retain calibration as long as the system arrangement is unchanged – i.e. no change in optical loss.

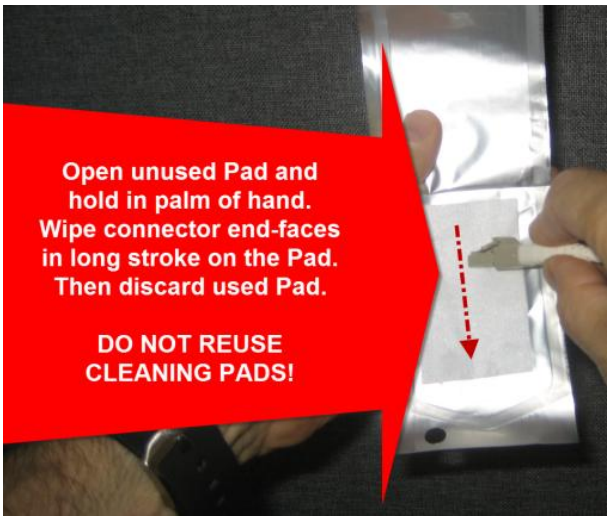
Fiber Optic Connector Cleaning:



IMPORTANT INFORMATION ABOUT FIBER OPTIC CONNECTORS

- Fiber Optic connectors must be kept clean from dust and other contaminants.
- Always keep unmated connectors covered with an appropriate dust cap.
- Do not touch the connector ends.

Micronor supplies the MR321C cleaning kit with every system order. Before mating - clean BOTH connector ends as shown below.



Insert a new Stick into Port A.
Twist twice, remove & discard.
Insert a new Stick into Port B.
Twist twice, remove & discard.
DO NOT REUSE
CLEANING STICKS!

MR320 Error Messages – Blink Codes

In normal operation, the PWR LED is continuously On. Approximately every 50 seconds the PWR LED blinks indicating execution of the internal Auto Calibration cycle, which is normal. This Auto Cal cycle only executes when the encoder is moving. The PWR LED starts blinking when a change or error in operation occurs. The number of blinks corresponds to an error code as shown below. Consult Section 7.5 of MR320 User Guide for additional information.

Blinks	Description – Cause – Remedy
1	EEPROM Error: Power down unit and re-initialize. If error persists, contact Factory.
2	2.5V Reference Voltage is out of tolerance: Contact Factory
3	Internal +5V Power Supply Voltage is out of tolerance: Contact Factory
4	Internal +12V Power Supply is out of tolerance: Contact Factory
5	The optical encoder cannot be calibrated properly Possible reasons: • Too much or too little optical power • High insertion loss in the data link NOTE: Five blinks indicate that the input optical AMPLIFIER is either at the minimum (3) or maximum GAIN (20) setting. If you install ZAPPY software and use the Diagnostics Mode, then allowable GAIN range is 3-20. When the amplifier is at its maximum GAIN setting (20), the reason is most likely: • High loss within the optical link – usually a connector problem. Install ZAPPY and run DIAGNOSTICS Mode. Consult User Guide for additional information. • Defective encoder • Defective module When the amplifier is at its minimum GAIN setting (3), the reason is most likely: • Power is too high • Defective module Contact Micronor factory or distributor for additional troubleshooting assistance.

How To Install ZAPPY Software

What is ZAPPY Software?

ZAPPY software is run on a PC and allows user to set the operating parameters of various functions (analog outputs, position counter, etc.), run Diagnostics to verify proper operation as well as to certify the fiber optic connections. Consult Section 5.9 of the MR3XX User Guide for detailed instructions but a summary follows here.

What do I need to install ZAPPY Software?

You will need the following:

- ZAPPY Installation CDROM
- An IBM-compatible PC running Windows XP
- One of the following cable adapters:
  - If PC has available serial port, use MR232-1 RS422-to-RS232 Adapter Cable
  - If PC has available USB port, use MR232-2 RS422-to-USB Adapter Cable

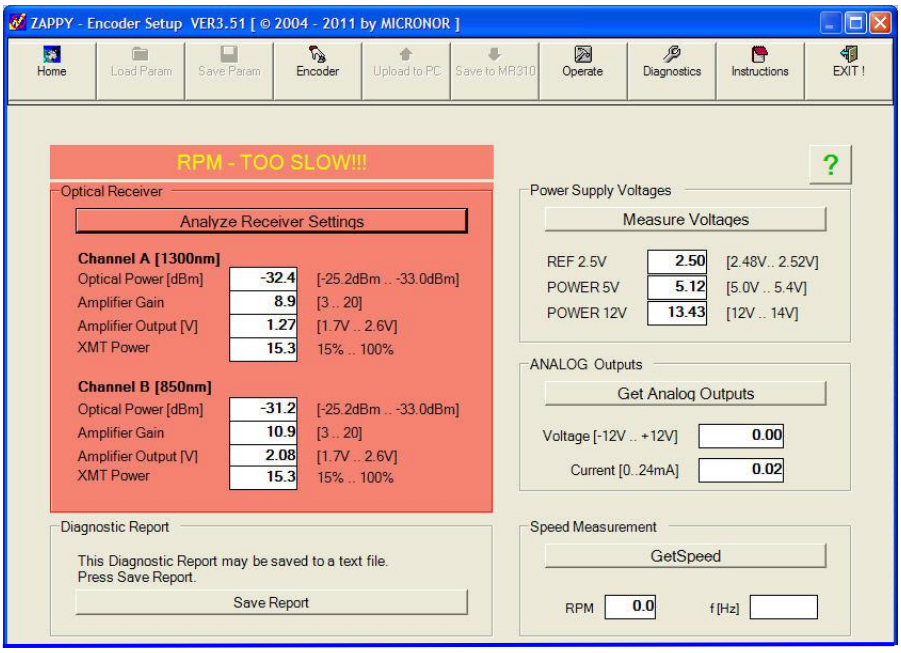
How do I install ZAPPY Software?

1. If using MR232-2 USB Adapter cable, first install USB software per supplied instructions.
2. Run SETUP.EXE on ZAPPY CDROM and install ZAPPY.
3. Connect the MR320 to either serial or USB port. Turn on power to MR320 module.
4. Run ZAPPY software. If using MR232-2 USB Adapter cable or port other than COM1, be sure proper COM port number is entered at ZAPPY Start-Up Screen per example below. NOTE: Version 3.5.1 of ZAPPY will find the MR320 automatically.

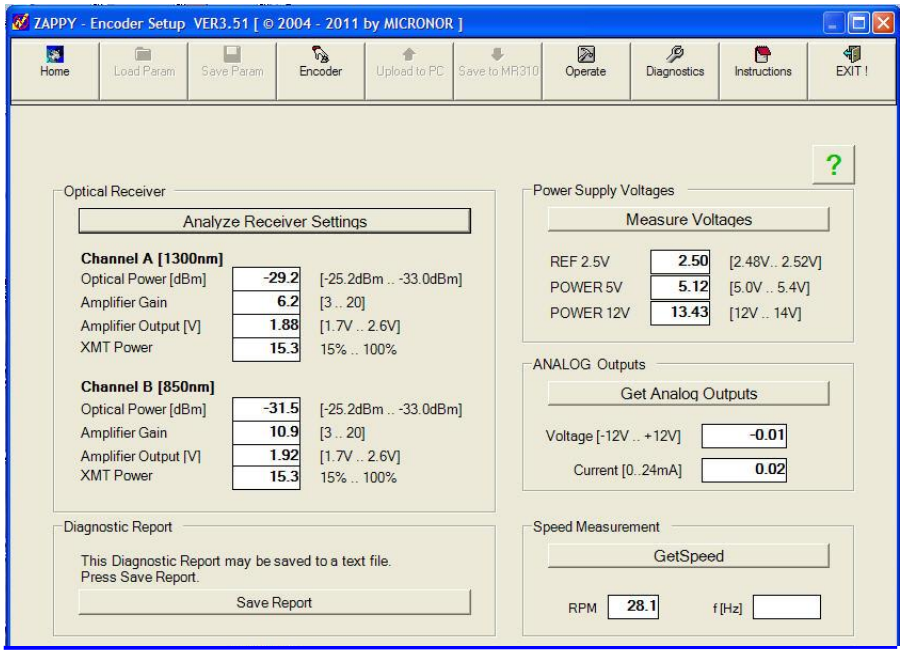
How To Test The Optical Link using ZAPPY

How can I verify if the Encoder/Module is properly connected and the optical connections meet requirements?

1. Click on [Diagnostics]. If the encoder is not rotating, you will get the following warning screen:

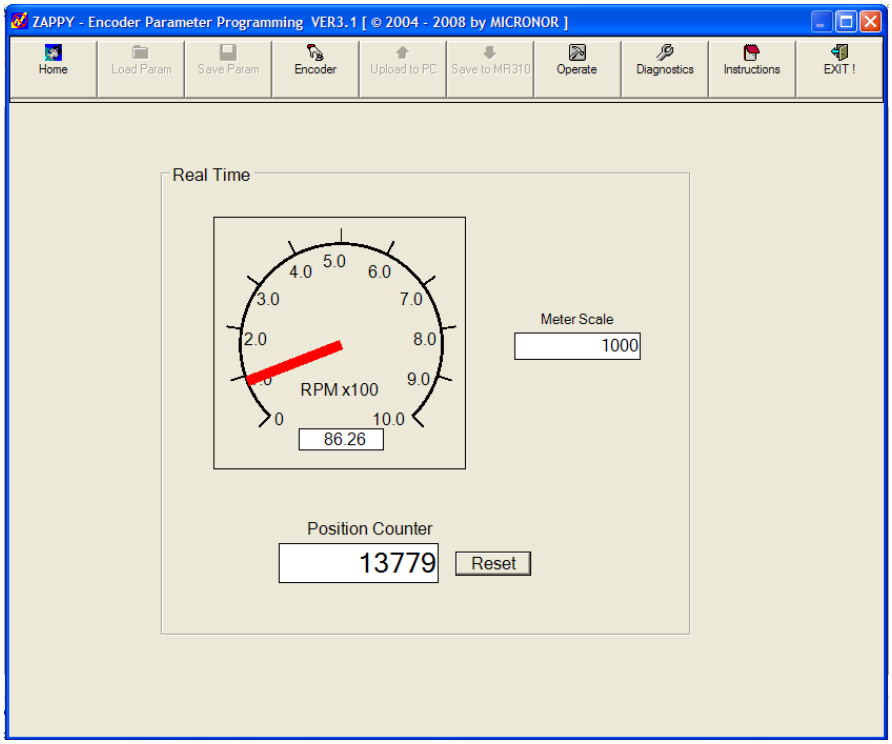


2. While rotating the shaft (**RPM-Too Slow!!!** warning will go away), click on [Analyze Receiver Settings]. All measured parameters should fall within range of allowed values shown in brackets **[...]** .

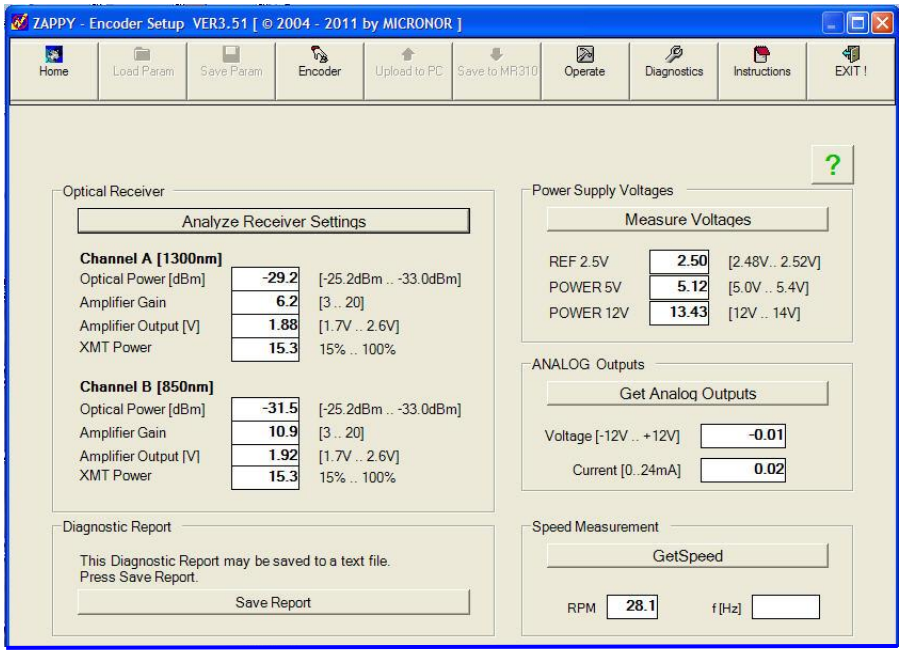


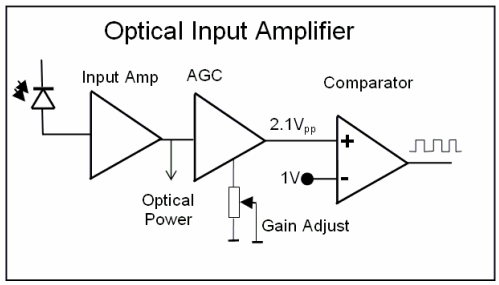
How can I monitor Encoder operation?

1. Click on [Operate] to view RPM and Position Counter value.
2. Run encoder and verify proper operation.



2. Click on [Diagnostics] to view internal signal status.

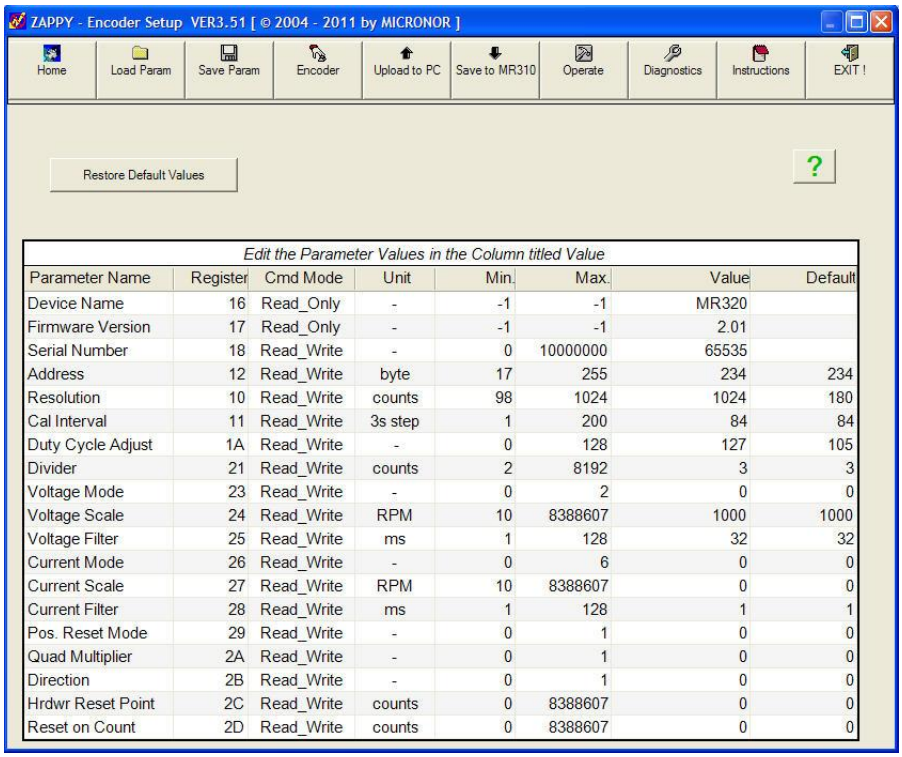




How To Use ZAPPY Software

How do I change operating parameters stored in the MR320?

1. First, click on the [Upload to PC] button view current settings.
2. Change settings as required. Consult MR320 Technical Manual for detailed information.
3. Click on [Save To MR320] to store all changes in the MR320's nonvolatile memory.
4. Operate the encoder and verify that the changes are functioning as expected.



Parameter Name	Register	Cmd Mode	Unit	Min.	Max.	Value	Default
Device Name	16	Read_Only	-	-1	-1	MR320	
Firmware Version	17	Read_Only	-	-1	-1	2.01	
Serial Number	18	Read_Write	-	0	10000000	65535	
Address	12	Read_Write	byte	17	255	234	234
Resolution	10	Read_Write	counts	98	1024	1024	180
Cal Interval	11	Read_Write	3s step	1	200	84	84
Duty Cycle Adjust	1A	Read_Write	-	0	128	127	105
Divider	21	Read_Write	counts	2	8192	3	3
Voltage Mode	23	Read_Write	-	0	2	0	0
Voltage Scale	24	Read_Write	RPM	10	8388607	1000	1000
Voltage Filter	25	Read_Write	ms	1	128	32	32
Current Mode	26	Read_Write	-	0	6	0	0
Current Scale	27	Read_Write	RPM	10	8388607	0	0
Current Filter	28	Read_Write	ms	1	128	1	1
Pos. Reset Mode	29	Read_Write	-	0	1	0	0
Quad Multiplier	2A	Read_Write	-	0	1	0	0
Direction	2B	Read_Write	-	0	1	0	0
Hrdwr Reset Point	2C	Read_Write	counts	0	8388607	0	0
Reset on Count	2D	Read_Write	counts	0	8388607	0	0

Explanation of MR320 System Parameters

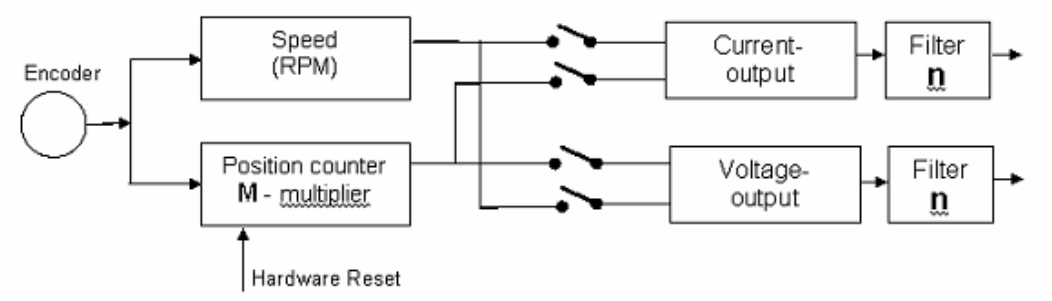
NOTE: System parameters are set by the factory and should not be altered by the user. The only exception is the RS422 address and the encoder resolution.

Parameter	Description	Comments
Device Name	MR320	Fixed. This is the model name.
Firmware Version	Version number of firmware	Fixed
Serial Number	Serial number of unit	Fixed
Address	RS422 bus address	This address may be changed by user when more than one unit resides on the same bus. Common address is 0. Unit always listens and responds to calls on address 0.
Resolution	This number must match the number of slits of the encoder	For example, MR324 encoder has resolution of 1024ppr (pulses-or slits-per revolution). Therefore, the number entered here should be 1024.
Cal Interval	Defines internal time span for automatic calibration check.	Cal Interval value represents multiples of ~3 seconds. A typical value is 82 (~4 minutes). If the value is 0, no automatic calibration will be performed.
Duty Cycle Adjust	This value is for adjustment of the quadrature signal duty cycle.	Typically it should be left between 50 to 70. An oscilloscope is required to adjust the setting.

Explanation of MR320 Operating Parameters NOTE: Operating parameters are used to define internal modes of operation and their variables.		
Parameter	**Description**	**Comments**
Divider	Divides quadrature outputs with separate output via DIVIDE A+B line driver outputs	Accepts values 2-8192.
Voltage Mode	Defines output mode (Speed or Position) and function of Voltage analog output	If Voltage output not to be used, then set Voltage Scale=0. Otherwise see following sections describing detailed Speed or Position setup of analog outputs for detailed information.
Voltage Scale	Determines Full Scale value if used for Speed or Position	If Voltage output not used, then set Voltage Scale=0. Otherwise see following sections describing Speed or Position setup of analog outputs for detailed information.
Voltage Filter	Determines time constant of low pass filter	If no filter function required, then set Voltage Filter=0. Otherwise see following sections describing Speed or Position setup for analog outputs for detailed information.
Current Mode	Defines output mode (Speed or Position) and function of Current analog output	If Current output not to be used, then set Voltage Scale=0. Otherwise see following sections describing Speed or Position setup of analog outputs for detailed information.
Current Scale	Determines Full Scale value if used for Speed or Position	If no filter function required, then set Voltage Filter=0. Otherwise see following sections describing Speed or Position setup for analog outputs for detailed information.
Current Filter	Determines time constant of low pass filter	If no filter function required, then set Current Filter=0. Otherwise see following sections describing Speed or Position setup for analog outputs for detailed information.
Position Reset Mode	Programs response of RESET input which resets Internal Position Counter to value either 0 or value of Hardware Reset Point	If value=0, Internal Position Counter resets on rising edge of hardware RESET input. If value=1, enables a debounce period for use of an external pushbutton wired to RESET input. For detailed information, see following section describing Position setup for analog outputs.
Quadrature Multiplier	Can increase resolution by clocking Internal Counter on the ½ quadrature cycle	Set value=0 for standard count mode and value=1 to double resolution. For detailed information, see following section describing Position setup for analog outputs.
Direction	Determines direction of encoder	Direction=0 for normal CW direction. Otherwise, Direction =1 to set reverse direction (CCW).
Hardware Reset Point	Internal Position Counter resets to this value when hardware RESET input is activated	For detailed information, see following section describing Position setup for analog outputs.
Reset On Count	Internal Position Counter is automatically reset to 0 whenever absolute value matches this value	Value=0 deactivates this mode. For detailed information, see following section describing Position setup for analog outputs.

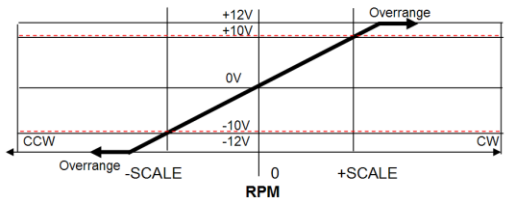
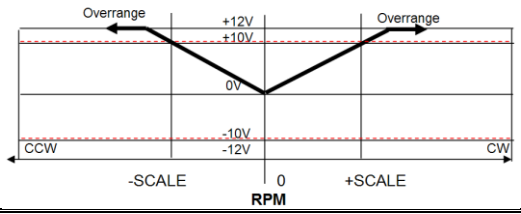
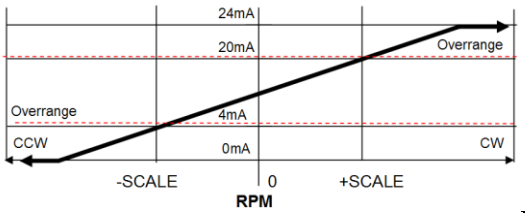
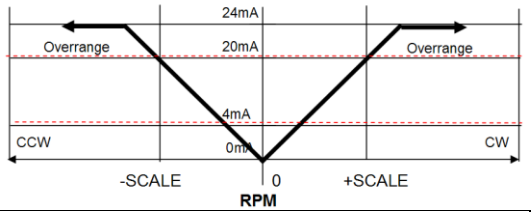
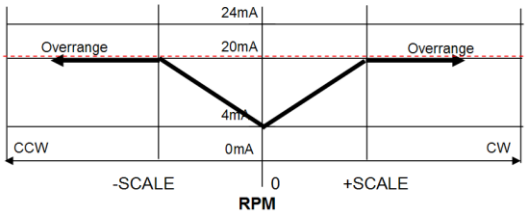
How do I setup the parameters for operating the Analog Outputs?

The two analog outputs can be independently configured as a Speed (RPM) or an absolute Position indicator. Any Full Scale value >0 will activate the output. The Mode defines which Function the output performs. Each analog output is followed by a programmable low pass Filter. Consult following summary or MR3XX User Guide for details.



How Do I Program The *Voltage and/or Current* Analog Output for Speed (RPM)?

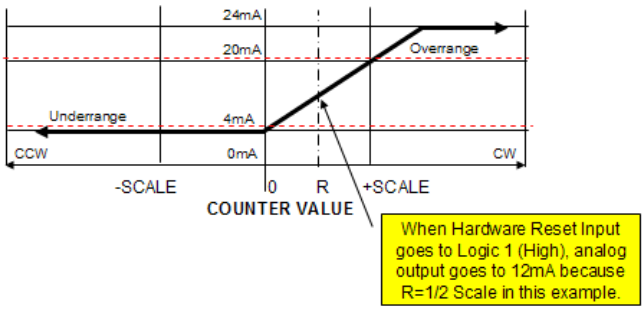
- **Encoder Direction** (Register 2B) accepts values of 0=CW (default) and 1=CCW
- **Output Function** (Voltage register 23 and Current register 26, see table below for output descriptions)
- **Full Scale** value (Voltage register 24 and Current register 27)
  - 0 turns the Voltage analog output OFF – regardless of selected Output mode
  - Accept full scale value of 10-10,000 (RPM)
- **Filter** values (Voltage register 25 and Current register 28)
  - Value 0 corresponds to no filtering
  - 1-256 correspond to the 3dB filter point per equation provided in the Technical Reference

Voltage SPEED Mode (Register 23)	
0	**Voltage Speed Mode 0** 
1	**Voltage Speed Mode 1** 
Current SPEED Mode (Register 26)	
0	**Current Speed Mode 0** 
1	**Current Speed Mode 1** 
2	**Current Speed Mode 2** 

How Do I Program The *Voltage and/or Current* Analog Output for POSITION?

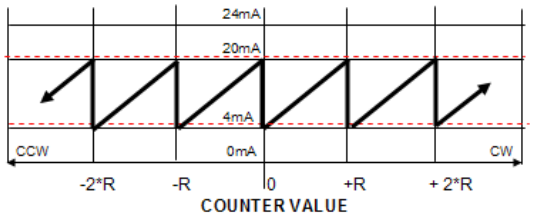
- **Encoder Direction** (Register 2B) accepts values of 0=CW (default) and 1=CCW
- **Output Function** (Voltage register 23 and Current register 26, see table below for output functions)
- **Full Scale** value (Voltage register 24 and Current register 27)
  - 0 turns the Current Voltage analog output OFF – regardless of selected Mode
  - Accepts full scale value of 1-8,388,607 counts
- **Filter** values (Voltage register 25 and Current register 26)
  - 0 corresponds to no filtering
  - 1-256 correspond to the 3dB filter point per equation provided in the Technical Reference
  - Default value is 32 (corresponding to 10Hz)
- **Counter Reset** mode (Register 29)
  - 0 = Counter is reset on first rising edge of RESET input
  - 1 = Allows debounce period of 60ms
- **Counter Multiplier** mode (Register 2A)
  - 0 = Normal counting (every cycle is one count)
  - 1 = Allows ½ quadrature cycle to increment/decrement internal Counter – effectively doubling the position resolution.
- **Hardware Reset Value** (Register 2C)
  - Internal Counter resets to this value when RESET input is activated
  - Accepts input value of 0-8,388,607
  - Sometimes this function is also called “homing”
  - Analog output value will be determined by Mode selected. Here is an example:

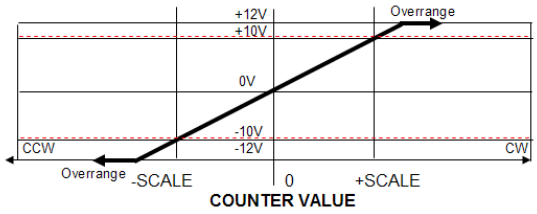
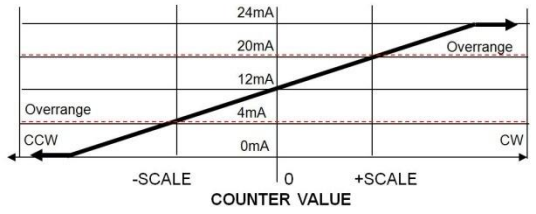
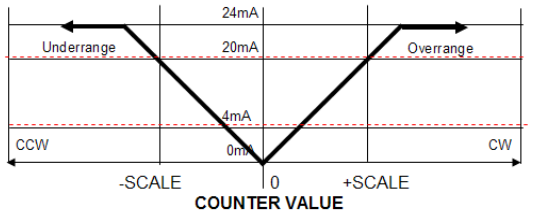
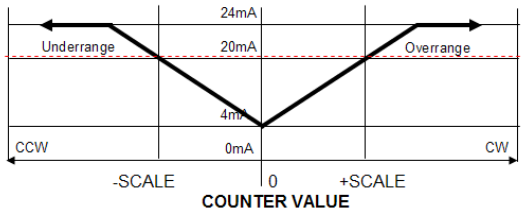
HARDWARE RESET VALUE Mode
(Example shown uses Current Position Mode 6
Where R (RESET Value) = ½ of Current Scale Value)



- **Reset On Count/Homing** mode (Register 2D)
  - Internal Position Counter is automatically reset to 0 whenever its absolute value matches this preprogrammed value
  - 0 = mode deactivated
  - Accepts input value of 1-8,388,607 for active mode
  - Here is an example:

RESET ON COUNT Mode
(Example shown uses Current Position Mode 6
Where R=RESET Value)



Voltage POSITION Mode (Register 23)	
2	**Voltage Position Mode 2** 
Current POSITION Mode (Register 26)	
3	**Current Position Mode 3** 
4	**Current Position Mode 4** 
5	**Current Position Mode 5** 
6	**Current Position Mode 6**